Information Bulletin No. 187

A Cornell Cooperative Extension Publication

Bait Hives for Honey Bees

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Introduction

In most parts of the United States many colonies of bees live in hollow trees and buildings. They are descendants of bees that escaped from beekeepers' hives and reverted to natural nests like those of their remote ancestors. By using special hives called bait hives or bait boxes, beekeepers may harvest swarms that issue from these or other colonies.

An understanding of how swarms choose their nest sites helps us design and situate bait hives to make them more likely to attract swarms. Observing the way a swarm selects and builds a new nest can provide important background information for successfully pursuing the art of beekeeping.

In many areas, the number of honey bee colonies in trees and buildings probably exceeds the number in human-made hives. All these colonies have chosen their homes. By studying naturally selected nests and experimenting with various types of hives we have developed bait hive recommendations for beekeepers.

In the Ithaca area of central New York State we have captured swarms in 80 percent of the bait hives we set out in good years—nearly a hundred swarms in some years. In our poorest year, fewer than 20 percent of the bait hives were occupied.

Capturing swarms can be an easy, inexpensive way to begin in beekeeping. However, a newly captured swarm, like a newly installed package of bees, rarely produces a surplus of honey for the beekeeper the first year. In fact, a swarm captured late in the season may need supplemental feeding to survive the winter.

What Is a Swarm?

When a colony of honey bees becomes large, it divides into two units. About 30 to 70 percent of the bees remain in the parent colony; the rest leave as a swarm. The bees in the swarm are predominantly workers, but a small fraction may be drones (males). Typically, each swarm has one queen, usually the old one from the parent colony (who is the mother of all the bees in the colony).

This painting by an unknown artist was purchased in a market in Nairobi, Kenya. East Africa has a tradition of beekeeping and harvesting beeswax and honey that goes back several thousand years. Each year, beekeepers get new colonies by placing empty handmade hives where they will attract swarms. Details in this painting are biologically and culturally accurate. The hive is an appropriate size, well off the ground, and shaded but easily visible. The shape of the tree shows the effects of the winds on the Nairobi plain. The men pictured are Masai, with their typical red dress, shields, and spears.

Some prosperous colonies cast more swarms in the days following the departure of their first ("primary") swarm. Each such "afterswarm" includes one or more young, virgin queens. We estimate that colonies in trees and buildings cast swarms nine years out of ten; those managed by beekeepers cast swarms less frequently.

The number of bees in a swarm varies greatly—from about 2,000 to more than 50,000. The swarms with the lowest populations are probably afterswarms, which tend to be much smaller than primary swarms. Very large swarms probably result from two or more swarms becoming confused and joining. Other factors affect swarm size, such as the volume of the nest cavity. Because a colony casts a swarm when its residence has become congested, colonies in small hives tend to swarm more frequently than those in large hives, with fewer bees per swarm.

Swarm populations average 10,000 to 12,000 bees, about the number in a three-pound package of bees. A swarm or package of bees weighing three pounds, installed in a hive in the spring, is considered a good starting unit for a beekeeper.

A swarm contains bees of all ages. Thus, even the day a swarm is hived the population declines due to the natural death rate. For the beekeeper, it is important that the queen begin to lay eggs and make replacement bees as soon as possible. A period of 21 days is required to grow a worker bee from egg to adult. Adult workers typically live only four to six weeks. Thus a swarm is a fairly frail unit.

In fact, eighty percent of swarms that move into natural nests fail to survive the first winter. Even the best beekeepers lose some colonies throughout the year, particularly during the winter. Good beekeeping involves reducing losses to an acceptable level.

When Does Swarming Occur?

Successful use of bait hives, especially timely harvesting, requires knowing when swarming is most likely to occur in one's area. In central New York State, 80 percent of swarming takes place between May 15 and July 15 (see Figure 1). Nearly 20 percent takes place between August 15 and September 15. The remainder—only 1 to 2 percent—occurs between mid-July and mid-August.

A similar pattern presumably holds in the rest of the United States, except that swarming starts earlier toward the south. Swarming in Maryland starts in April, for example, and in Florida in late February or March. For New York, we recommend capturing and hiving spring swarms only; late summer and fall swarms require too much feeding and other attention to be worthwhile, and even then may not survive the winter.

In general, a honey bee colony swarms only if the bees are relatively congested during the swarming season. This means that colonies that swarm tend to be those with populations that build up the fastest. Thus the timing of spring swarming is closely tied to the speed of colony buildup.

Population growth is affected by various factors, including the availability of food, the ease with which the colony can control its hive environment (for example, colonies with damp bottom boards have more difficulty controlling the temperature for rearing brood), the age of the queen (young queens generally lay more eggs than old queens), and the presence or absence of disease.

The amount of space available also contributes to crowding. When bees select their own nest they prefer cavities smaller than the hives that are generally used for bee husbandry. The small nests tend to encourage swarming.

As shown in Figure 1, only three of the more than 200 swarms we observed emerged before May 15. Two of these were cast in different years from the same bee tree, at a low elevation on a hill west of Ithaca. The fact that swarming in this spot occurred exceptionally early indicates the importance of microclimate for honey bees.

Microclimate should be considered carefully when selecting sites for apiaries. The more favorable the conditions, the more likely that colonies will grow rapidly and prosper. For a natural, unmanaged colony, this can mean more swarming, or swarming earlier in the season; for a beekeeper, it can translate into greater honey production.

The departure of a swarm from its parent colony may take only five to ten minutes, but noticeable preparations begin up to 10 days in advance. For example, colonies send out scout bees to search for new homesites several days before the entire swarm issues. Searching scouts can be seen flying up and down tree trunks investigating knotholes and other openings. In Central New York, the search for homesites may begin as early as the first week in May, so bait hives should be in place before then.

During this period of preparation, in many workers the four pairs of wax glands on the underside of the abdomen go through development. Thus the bees in a swarm are primed to build new comb rapidly. A beekeeper can take advantage of this and use a new swarm to draw good combs from foundation.

Bait hives should be inspected and harvested frequently because within weeks of occupying a new home a swarm can make a great quantity of fragile new comb. This may make moving full bait hives difficult, as overheating may cause the comb to melt, or undue jarring may break comb and kill bees.

Other swarm preparations are made by a colony. Queen cells are built and provisioned, and the queen lays eggs in them. Generally, by the time the primary swarm issues forth,

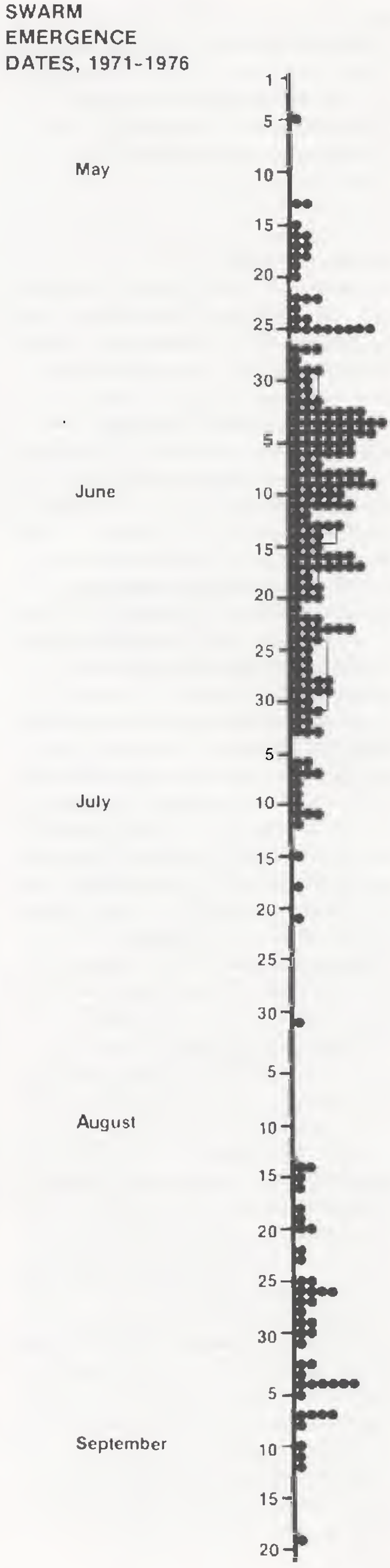

Figure 1. The dates of swarming in the Ithaca, N.Y., area (data from 1971 through 1976). Each dot represents a swarm that emerged on the date shown. This information indicates that bait hives should be in place by May 1 to attract scouts and be fully effective.

the cells are capped, which means the developing queens are in the late larval or pupal stage. The old queen loses up to one-third of her weight in the weeks before swarm departure, which enables her to fly with the swarm.

House Hunting by Bees

There is division of labor in a honey bee colony; individual bees specialize in different tasks. For example, all the food gathering is done by the older workers. Among these, a small fraction (5 percent is probably typical) act as food scouts. They find new patches of flowers and then recruit other workers to collect the nectar and pollen. The recruits rarely, if ever, explore for new food sources on their own, relying instead on information from the scouts.

At swarming time, scout bees (presumably the same ones that functioned as food scouts) seek out and evaluate new nest sites. In experiments aimed at learning which nest characteristics are important and what the scouts prefer, we offered bees specially built bait hives (usually cube-shaped) in pairs; within each pair the hives differed in only one respect. For each pair, we recorded which of the hives was chosen by a swarm.

Results of choice tests for many swarms yielded 12 recommendations for bait hive design (see box).

Some factors remain to be researched. Bait hives that meet all the criteria are passed up by some swarms for unknown reasons.

The color of the hive exterior appears to be unimportant, except that darker boxes may overheat in hot climates unless they are fully shaded. Colors that provide some camouflage reduce human vandalism without discouraging the bees.

The boxes pictured in this bulletin were made with 5/8-inch-thick plywood, but other materials can be used. Both sturdy cardboard boxes and lightweight molded papier-mâché plant pots (available from nurseries) have been used successfully in areas with dry climates.

Recommendations for Bait Hive Design

1. HEIGHT: about 15 feet (5 meters) above the ground.
2. SHADE AND VISIBILITY: well-shaded, but highly visible. Bees avoid or abandon bait hives in direct sun.
3. DISTANCE FROM PARENT NEST: not important.
4. TOTAL ENTRANCE AREA: about 1½ to 2 square inches (10 to 15 cm^2); a circular opening about 1¼ inch (3.2 cm) in diameter is suggested.
5. ENTRANCE SHAPE: not important.
6. ENTRANCE POSITION: near the floor of the hive.
7. ENTRANCE DIRECTION: facing south preferred, but other directions are acceptable.
8. CAVITY VOLUME: about 1.4 cubic feet (40 liters). This is about the volume of one standard ten-frame Langstroth hive body (see Figures 2 and 3).
9. CAVITY SHAPE: not important.
10. DRYNESS AND AIRTIGHTNESS: dry and snug, especially at the top.
11. TYPE OF WOOD: various types acceptable; many types of trees have been occupied. Bees may avoid new lumber.
12. ODOR: the odor of beeswax is attractive. However, putting in pieces of comb is not advisable, as comb also attracts wax moths and can harbor disease organisms. If a hive body is used as a bait hive, a good solution is to insert a few wired frames, each containing a strip of foundation. Commercially available chemical lures that smell like lemon grass and apparently mimic the scouts' communication scents work well and can be used in bait hives of any shape.

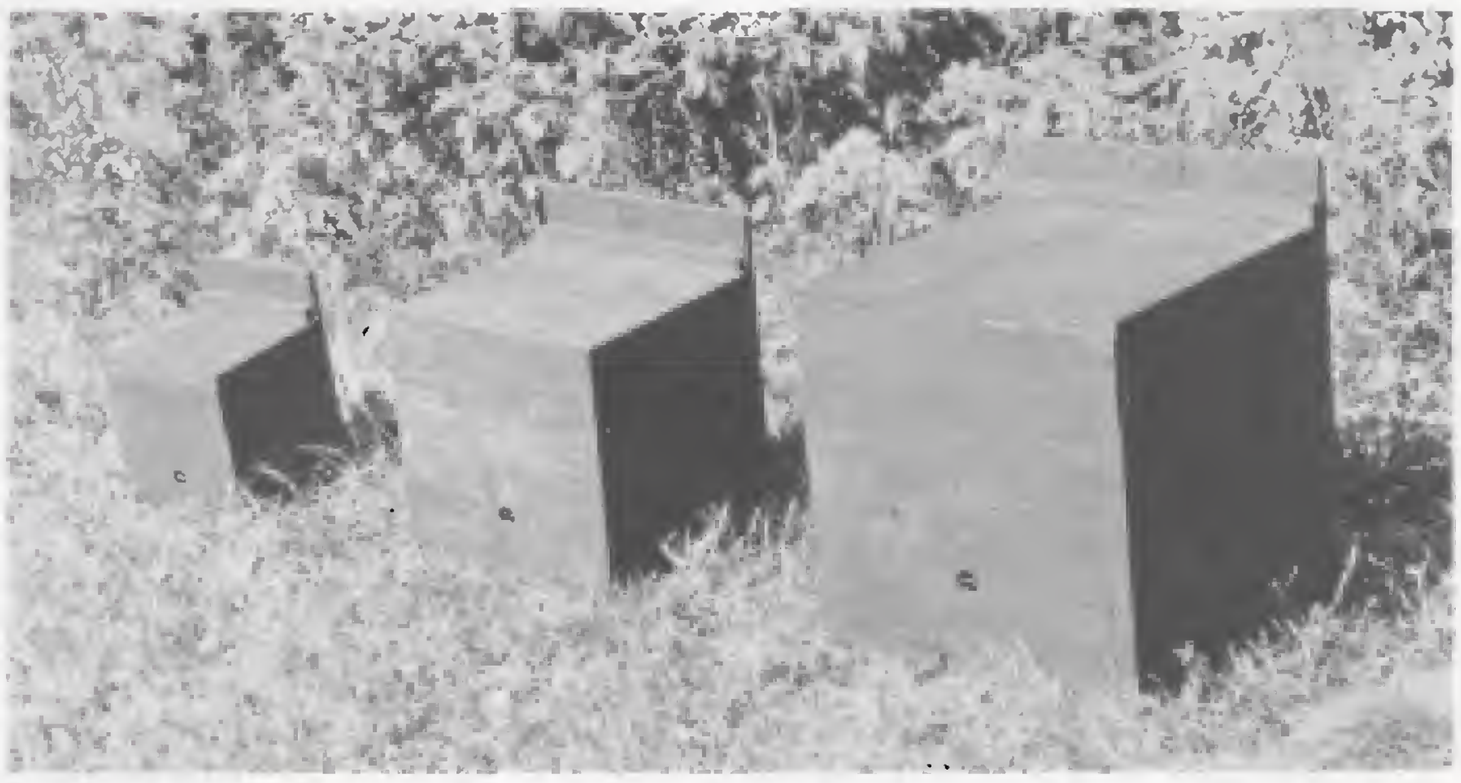

Figure 2. We tested bait hives of varying sizes. These had volumes of 10, 40, and 100 liters. When hives were mounted on trees a few meters apart, swarms usually chose the middle-sized (40-liter) one, shown in detail in Figure 3. When only the smallest and largest boxes were available, some swarms accepted the large box (100 liters) but none accepted the 10-liter box. We found no relation between the population of the swarm and the size box selected.

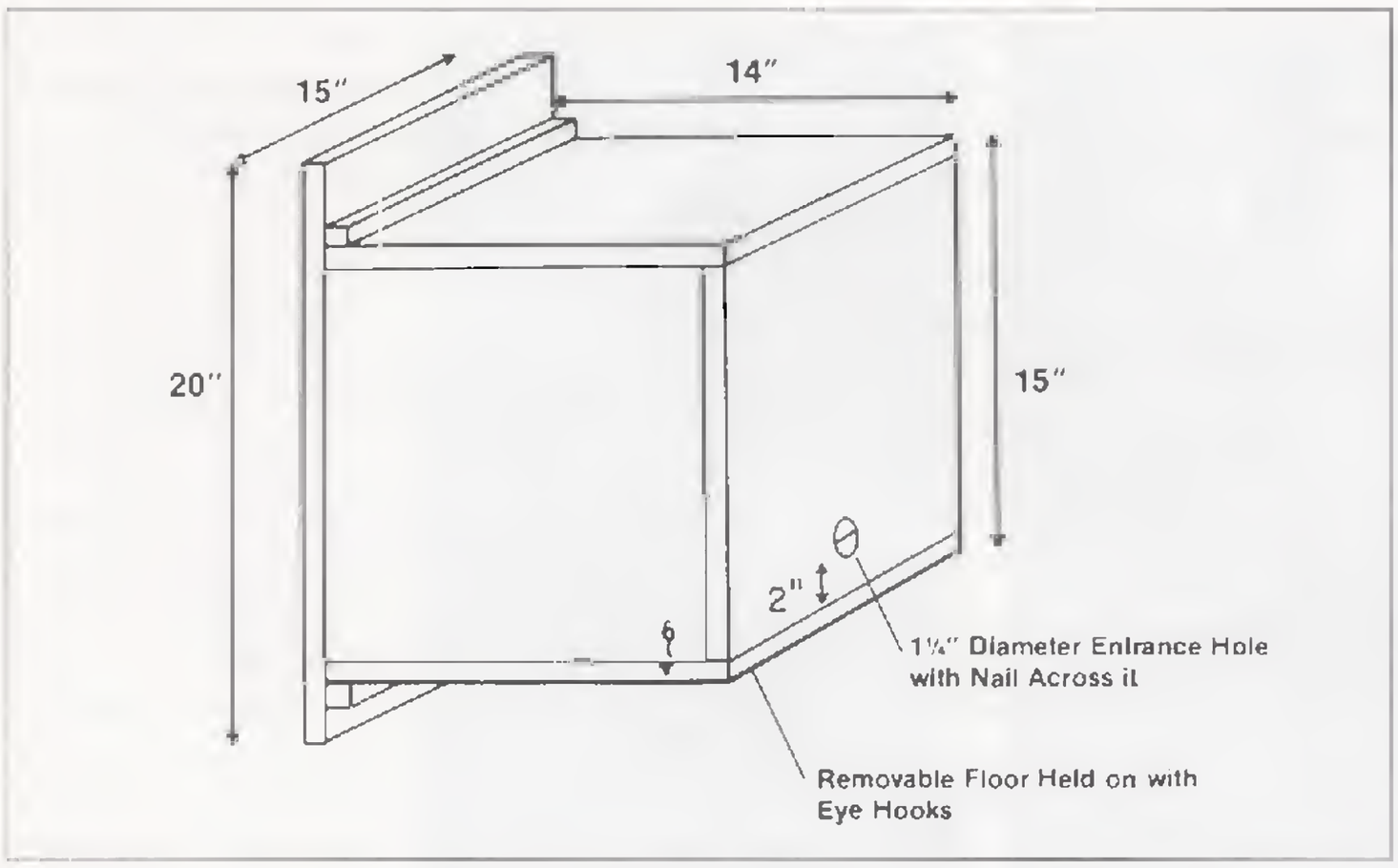

Figure 3. Most of the experimental bait hives were 15-inch (38-cm) cubes made of 5/8-inch (1.6-cm) plywood. We found that the shape of the bait hive is not a major factor but the volume is quite important to honey bee swarms. Our data suggest that a sturdy box about the size of a standard 10-frame Langstroth super is satisfactory.

Building a Bait Hive

A bait hive attracts scout bees and a swarm only if built properly, so be sure to follow the recommendations listed in the box at left. The dimensions of the wooden boxes used in our research are shown in Figure 3. We used only cubes after data indicated the shape of the hive is not important.

The box should be built so it can be opened easily to examine the nest. A removable top makes transferring the bees into a permanent hive much easier. An excellent approach is to nail a top and a bottom to a standard Langstroth hive body (often called a super) and use it as a bait hive. The top will be easy to remove later if the nailheads are left slightly exposed, rather than driven in flush with the wood.

The bait hive must have a projecting piece of wood or some type of hanger so it may be fastened to a tree and later removed. It is frustrating to find that a box has fallen to the ground because of poor nailing or to struggle with removing a box from a tree because it was nailed in place too securely. Also, a nail or piece of wire mesh across the entrance hole prevents birds from nesting in the bait hives while maintaining free access for the bees.

Dryness and snugness are very important. To prevent any light or water from entering from the upper portion of the nest, all cracks must be sealed. Duct tape works well for this.

Positioning Bait Hives

Success in using bait hives depends on proper site selection. A good location for a bait hive is about 15 feet (5 meters) above the ground, highly visible (to maximize the likelihood of discovery by scouts), and fully shaded. Figure 4 shows three well-located hives. The picture on page 2 illustrates an ideal site in Kenya, East Africa, where bait hives have been used for centuries.

Even the most carefully chosen location may be ignored or rejected by bees. Inducing scouts, and then swarms, to enter bait hives is only the first step. We have observed swarms moving into bait hives only to reject them an hour or a day later. Overheating of the hive seems to be a contributing factor. Once bees have built combs and have brood, however, they rarely abandon a new home.

Inspecting Bait Hives

In our experience, leaving bait hives in place to overwinter is a poor practice; very few colonies survive. Although we have no data, we believe that bait hives are not as protected as tree cavities and that the winter death rate of colonies left in bait hives is much higher than the normal 15 to 20 percent loss of established colonies in tree holes. But it may not be significantly higher than the 80 percent mortality of colonies in bee trees during their first year after moving in as a swarm.

Bait hives should be checked frequently, both to obtain data about when they were occupied and to pick up the bees. It is much easier to take down a recently occupied bait hive than one that has been left in place until the weight of the honey and the population of bees have increased significantly.

The key sign of occupancy is bee flight around the entrance. However, such activity may merely indicate that the hive is being investigated by scout bees. The surest sign that a swarm has moved in is incoming bees carrying loads of pollen. Home-seeking scouts do not carry pollen. Not all bees collect pollen, however, and at certain times of the year in certain localities there may be a dearth of pollen. Also, a colony with only 2,000 to 5,000 bees may show markedly little activity at a hive entrance.

Another useful distinction between scouts from a swarm and foragers from a colony that has taken up residence is the pattern of flight around the hive. Bees scouting a potential nest site move repeatedly in and out of the entrance, sometimes taking short flights but returning again and again for further inspections of the interior. Most foragers, in contrast, either leave the entrance quickly or stand there for a while, rapidly groom themselves, then fly off directly. Sometimes, especially in the early afternoon, bees leaving an occupied hive are young bees taking orientation flights; they trace widening figure-eight patterns in the air.

Figure 4. These bait hives were among those occupied by swarms. Their placement illustrates the types of locations that are appropriate. The signs show the numbers assigned to the locations, and the arrows indicate the direction of the bait hive entrance (straight up would mean it faced north).

Taking Down a Bait Hive

Consider safety when bringing down a bulky hive. It is not an easy object to carry on a ladder. An occupied bait hive may weigh as much as 60 to 80 pounds (27 to 36 kilograms). In some areas bait hives get heavy early in the season when there has been a good honey flow. If nectar is abundant, a colony can harvest several pounds of honey in a single day. Even a hive without much stored honey can contain many pounds of adult bees and brood.

A beekeeper can approach and handle an occupied bait hive as he or she would any other colony, but there are special considerations because of the awkwardness of working on a ladder. Placing the ladder against a tree and climbing it may arouse guard bees and make them more likely to attack before you can smoke the entrance.

A smoker should be lit and ready before the ladder is placed against the tree. It may be possible to allow smoke from below to drift up to the entrance before approaching the hive, but this is usually difficult to do effectively. Climb the ladder with care to keep vibrations to a minimum, and smoke the bait hive entrance quickly.

It is important to tie an occupied bait hive into place carefully with rope before removing the nails that hold it to a tree or other object. Use one end of the rope to secure the hive and place the other end around a limb above the hive and tie it to the ladder. Remove the nails, then untie the end of the rope attached to the ladder and allow the hive to slide gently down one of the side rails of the ladder, or let the hive hang free of the ladder and slowly lower it to the ground.

Remember that new comb is weak, lacking the old cocoons and propolis that strengthen old comb. It is especially susceptible to damage without the wired frames and woodenware present in a hive. If comb is broken as a bait hive is lowered to the ground, there is danger of killing bees and losing honey. Honey dripping from a bait hive causes a mess and, when nectar is scarce, may cause robbing.

To avoid breaking comb, keep the bait hive right side up while lowering it to the ground. Problems may be minimized if the bait hive is made from a super and is provided with wooden frames holding strips of foundation for comb building.

Transporting a Bait Hive to an Apiary

After a bait hive has been taken down, it can be transported to an apiary. Screening the entrance facilitates the moving operation. Attach the screening at a time when darkness, cool temperatures, or rain keeps all the bees inside the hive.

First gently smoke the entrance and any bees clustered on the outside of the hive; carefully smoked bees should crawl into the hive. Then use duct tape to fasten wire screening over the entrance. Nails or tacks can also be used, but hammering stirs up the bees. Eight-mesh hardware cloth is a good type of screening to use. Ordinary fly screening, which has 12 to 14 wires per inch, is also satisfactory but is not as strong.

The screening should be removed as soon as possible after the bees are in their new location. Under no circumstances should a hive remain screened all day, especially if it is exposed to the sun, because overheating can kill the colony and with a closed entrance the bees cannot regulate hive temperature.

Screening must be undertaken with caution. Bait hive entrances are small and ventilation is limited. In a

hive filled with bees, brood, and food, the excited bees may generate so much heat that combs begin to soften and break and bees begin to suffocate.

Moving bees in the cool of the early morning helps prevent these problems, but sometimes other approaches are also necessary. Migratory beekeepers moving large numbers of colonies rarely screen individual hives. They generally use closed, refrigerated trucks or open trucks on which a large net may screen the entire load. Each colony entrance is left open so the bees can cluster outside their entrance if necessary. Reducing the mass of bees inside the hive prevents it from overheating.

Transferring Bees to a Movable Frame Hive

An occupied bait hive lacking movable frames is illegal as a permanent hive in most states. This is because adequate inspection for disease is impossible. In addition, such a hive is inefficient. All captured swarms should be transferred to movable frame hives.

Transferral must be done early enough in the season that a colony has time to store sufficient pollen and honey for its winter food. The first of August in the northern states is probably the latest appropriate date, and even that date may be risky. Little can be done with a bait hive later in the season except to feed it as well as possible, place it on a hive stand, provide some winter protection, and hope it survives until the bees can be moved to a permanent hive in the spring.

There are several ways to carry out the transfer. If the swarm has built little or no comb, remove the top or bottom of the bait hive and dump the bees unceremoniously into or in front of an unoccupied standard hive with drawn combs or frames with foundation. Occasionally bees reject such a home, but including a frame with even a small amount of brood greatly increases the chance of acceptance.

Bees are much less likely to abandon a new home if they are hived in a light rain or in the evening. Direct sunlight, dampness, the odor of new wood and paint, or other physical disturbances sometimes prompt a swarm to abscond. If a swarm does leave the hive, it usually settles nearby in a bush or tree, and you may try again to hive it in the same manner. Bees that have rejected a hive once may accept it on the second try.

A bait hive in which the bees have built significant comb should be handled differently. Well-established bees are much more reluctant to leave, and the brood and food stores represent a valuable resource that should be preserved if possible.

If the bait hive has been supplied with wooden frames and the comb has been built in them, the transfer is easy. Otherwise, a fairly simple method is to place the bait hive on a hive stand, remove the top (or bottom, if you've turned the bait hive upside down), and place a super of empty combs on top. This is especially convenient if the bait hive itself is a super, or has the same dimensions as one. The bees expand their home into the upper super, as it is natural for the brood nest to develop upward.

Check the upper super for brood in a week or two. If it contains eggs, place a queen excluder between the two units with the hope that the queen is in the upper one. Check the upper unit again after three days. If there are eggs, the queen is there; if not, remove the excluder for a few days and repeat the process.

After the queen has been confined in the upper super for 24 days, no brood will be left in the combs below because no new eggs will have been laid and all the worker and drone brood will have hatched. Place the upper super on a bottom board and the transfer is complete.

Then harvest the wax comb from the bait hive for rendering and rinse off any spilled honey; the bait hive is ready for reuse. Small remnants of beeswax and propolis from the previous use will make the bait hive all the more attractive.

A method of speeding up the transfer is to use drumming, a centuries-old practice used to remove bees from straw skeps and boxes. Place a new super of combs above the bait hive (the new super must have a cover, as bees will not drum into an open box). Then, using hands or a lightweight rubber hammer, beat rhythmically on the side of the bait hive. If a moderately slow, steady beat is maintained, the bees should abandon the hive (even leaving their brood behind) and march upward in an orderly manner. Drummed bees do not become angry, but at the outset of drumming always smoke a colony carefully.

Still another method of transferring bees from a bait hive is to remove the cover, cut the combs from the hive one by one, and shake the bees into a super of drawn comb. This method causes much alarm and the air may fill with angry and confused bees. Bees adapt to a new hive more rapidly if it contains a frame with some brood. If the queen can be found and caged in the new hive her presence will attract and calm the bees. This system should not be used when there are other colonies in the immediate vicinity, as lost bees may drift into the other colonies and perhaps ball the resident queens.

When bees are transferred from bait hives with comb there is a choice of discarding the brood and comb or saving some by cutting and tying it into a frame. Saving comb is not easy, but it can be done. The easiest method is to lay several pieces of string parallel on a flat table, place a wooden frame without wires over the string, and put large pieces of comb in the frame. Be sure to place the comb in an upright position, just as it was in the bait hive. Then tie the comb in the frame. Use cotton string, which the bees can chew apart and remove from the hive in a few days. By then other bees will have fastened the comb in place with wax.

New combs made in this way are rarely satisfactory for brood rearing or

honey storage. In the long run, they are usually discarded in favor of better-built wired combs. Their advantage is that young bees from brood comb saved in this manner bolster the colony population, and keeping brood in the new hive aids in preventing absconding.

Special Considerations

Some captured swarms may be undesirable additions to an apiary. They may well be from stock with a higher-than-average tendency to swarm or may have other drawbacks, such as being unusually likely to sting. Of course, the beekeeper can alter these and other inherited traits by requeening.

Another important consideration is that a swarm may harbor disease that can spread to other colonies if the swarm is installed in an apiary. Therefore, inspect and monitor newly hived swarms carefully, checking especially for signs of American foulbrood or parasitic mites.

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Further Information

The following publications are available from Cornell Cooperative Extension.

Beekeeping: General Information 139-IB-90.

Identification and Prevention of American Foulbrood in Honey Bees 139-LFS-925.00.

Package Bees: Their Installation and Immediate Care 139-IB-7.

Small-Scale Queen Rearing by Beekeepers in the Northeast 139-IB-209.

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Produced by Media Services

86/155 rev. 10/89 3M MS E90176